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| APPLICATION NO.   | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|---------------------|------------------|
| 10/766,108  | 01/27/2004  | Abraham D. Strook    | H0498.70189US00     | 2195             |
| 7590  | 05/25/2006  |                      | EXAMINER            |                  |
| Timothy J. Oyer, Ph.D.<br>Wolf, Greenfield & Sacks, P.C.<br>600 Atlantic Avenue<br>Boston, MA 02210 |             |                      |                     | SORKIN, DAVID L  |
|   |             | ART UNIT             |                     | PAPER NUMBER     |
|   |             | 1723                 |                     |                  |

DATE MAILED: 05/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/766,108             | STROOK ET AL.       |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | David L. Sorkin        | 1723                |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) Responsive to communication(s) filed on 06 March 2006.
- 2a) This action is **FINAL**.                            2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) Claim(s) 1-52 and 68-74 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) Claim(s) \_\_\_\_\_ is/are allowed.
- 6) Claim(s) 1-32, 34-52 and 68-74 is/are rejected.
- 7) Claim(s) 33 is/are objected to.
- 8) Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on \_\_\_\_\_ is/are: a) accepted or b) objected to by the Examiner.  
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) All    b) Some \* c) None of:
  1. Certified copies of the priority documents have been received.
  2. Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
 Paper No(s)/Mail Date \_\_\_\_\_.
- 4) Interview Summary (PTO-413)  
 Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Claim Objections***

1. The claim amendment filed 06 March 2006 fails to comply with 37 CFR 1.75(f) which reads "If there are several claims, they shall be numbered consecutively in Arabic numeral". The amendment list two claims "42", no claim 43, no claim 71, and two claims "73". For the purpose of this office action the claims have been renumbered as follows:

Claim 42 (the first one) = claim 42

Claim 42 (the second one) = claim 43

Claim 72 = claim 71

Claim 73 (the first one) = claim 72

Claim 73 (the second one) = claim 73

### ***Claim Rejections - 35 USC § 112***

2. Claims 37-50, 71 and 72 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In claim 37, the double recitation of "a channels surface" is confusing. Subsequent reference to "the channels surface" is ambiguous. First "a channel surface having grooves or protrusions" is recited and later "a channels surface having a plurality of chevron shaped grooves or protrusions" is recited. In each of claims 39, 43, 44, 45, 47, 48, 49 and 50, the term "the channel" is used. It is unclear if "the channel" refers to the first channels, the second channel or the third channel, or some other channel. Also, although independent claim 37 already

requires that each of the three channels have a width less than about 1000 microns, claim 43 (i.e. the second claim 42) states that "the channel" is has a width less than about 1000 microns. In any amendment correcting the indefiniteness, duplicate claims should be avoided.

***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
- (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

4. Claims 1, 5-11, 13-30, 32, 35, 36 and 68-70 are rejected under 35 U.S.C. 102(a & e) as being anticipated by Larsen (US 6,241,379) and under 35 U.S.C. 102(b) as being anticipated by the corresponding WIPO publication, WO97/28894. All column and line numbers referred to herein below refer to the U.S. patent. Regarding claim 1,

Larsen ('379) discloses a an article (1) comprising a microfluidic channel (3) designed to have fluid flow therethrough in a principle direction, the channel including a surface having at least one groove or protrusion (7) having a first orientation that forms an angle relative to the principle direction and the at least one groove or protrusion extends from the sidewall (6) (see Figs. 4-7). Regarding claim 5, the substrate is a polymer (see col. 8, lines 23-24). Regarding claim 6, the angle is less than 90 degrees (see Figs. 4-7 and col. 7, lines 35-41). Regarding claim 7, the groove or protrusion has a depth that is less than a width of the channel (see Figs. 1 and 4-7). Regarding claim 8, the groove or protrusion has a depth less than a depth of the channel (see Figs. 1 and 4-7).

Regarding claim 9, the groove or protrusion has a width that is less than a width of the channel (see Figs. 1 and 4-7). Regarding claim 10, the channel includes a first inlet (2). Regarding claim 11, the channel has a second inlet (11). Regarding claim 13, there is a first set of grooves or protrusions of the surface (see Figs. 4-7). Regarding claim 14, the grooves or protrusions are parallel (see col. 5, line 16; Fig. 4-7). Regarding claim 15, the parallel grooves or protrusions are periodically spaced to form a first set (see Figs. 4-7). Regarding claim 16, the channel has a width and the first set of parallel periodically spaced grooves or protrusions traverse the width (See Figs. 4-7).

Regarding claim 17, the channel has a second set of parallel periodically spaced grooves or protrusions traversing at least a portion of the channel surface at a second orientation (see Figs. 4-7). Regarding claim 18, the second set of parallel periodically spaced grooves or protrusions are at least partially coextensive with the first set (see Figs. 4-7). Regarding claim 19, the first and second sets form a repeating pattern (see

Figs. 4-7). Regarding claim 20, the groove or protrusion has at least two sections (see Figs. 4-7). Regarding claim 21, at least one section is substantially linear (See Figs. 4-7). Regarding claims 22-24, a plurality of chevron shaped grooves are periodically spaced along the channel surface (see Fig. 7). Regarding claim 25, a second groove or protrusion is defined in the channel surface, the second groove or protrusion having a second orientation relative to the principle direction (see Figs. 4-7). Regarding claim 26, the substrate has a network of microfluidic channels (11) connected to the channel. Regarding claim 27, the microfluidic channel is formed in a unitary substrate (see col. 6, lines 18-27). Regarding claim 28 and 36, Larsen ('379) discloses a an article (1) comprising a microfluidic channel (3) constructed and arranged to a have a fluid flowing therethrough while creating a transverse component, the microfluidic channel including a surface having at least one groove or protrusion (7) defined therein, the mircrofluidic channel having a cross section defined between a first sidewall (6) and a second sidewall (20), wherein the at least one groove or protrusion (7) extends across a majority of the cross section between the first sidewall and the second side wall. Regarding claims 29 and 30, Reynolds number being low is achieved simply be having a low flow rate; therefore, these claims do not further structurally limit the claimed article. Regarding claim 32, a network of microfluidic channels (11) are fluidically connected to the channel. Regarding claim 35, the channel has a rectangular cross section (see Fig. 5). Regarding claims 68 and 69, the channel surface has a groove (see Figs. 4-7). Regarding claim 70, the groove or protrusion extends for first sidewall (6).

5. Claims 1-20, 25-32, 34-36 and 70 are rejected under 35 U.S.C. 102(b) as being anticipated by Desai et al. (US 5,921,678). Regarding claim 1, Desai ('678) discloses an article comprising a microfluidic channel (for example 140) defined therein designed to have a fluid flow therethrough in a principle direction, the channel having including a side wall (210) and a channel surface having at least one protrusion (510) the forms an angle relative to the principle direction and the at least one groove or protrusion extends from the sidewall (see Figs. 5A and 5B). Regarding claims 2-4, channels being 150 microns deep are disclosed (see col. 4, lines 34-40). Regarding claim 5, the substrate comprises a polymer (see col. 5, lines 11-12). Regarding claim 6, the angle is less than 90 degrees (see Fig. 5A). Regarding claim 7, the protrusion has a depth that is less than the width of the channel (see Fig. 5B; col. 4, lines 35-40). Regarding claim 8, the protrusion has a depth that is less than a depth of the channel (see col. 5, lines 62-63). Regarding claim 9, the protrusion has a width that is less than a width of the microfluidic channel (see Fig. 5B). Regarding claims 10 and 11, the channel has first and second inlets (corresponding to 110 and 112). Regarding claim 12, the channel includes a portion with a circular cross section (see Fig. 2). Regarding claim 13, a first set of protrusions (510) are formed on the surface of the channel (see Fig. 5A). Regarding claim 14, the protrusions are parallel to each other (see Fig. 5B). Regarding claim 15, the protrusions are periodically spaced (See Fig. 5A). Regarding claim 16, the first set of parallel periodically spaced protrusions is transverse to the width (see Figs. 5A and 5B). Regarding claim 17, the channel has a second set of parallel periodical spaced protrusions (see Fig. 5A). Regarding claim 18, the protrusion are at least partially

coextensive (see Fig. 5A). Regarding claim 19, the protrusions form a repeating pattern (see Fig. 5A). Regarding claim 20, anything can be reasonably considered to have any number of “sections”. Regarding claim 25, a second protrusion is disclosed (see Figs. 5A and 5B). Regarding claim 26, the substrate has a network of microfluidic channels fluidically connected to the channel (see Fig. 2). Regarding claims 28 and 36, a microchannel (for example 140) is constructed can arranged to have a fluid flowing therethrough while creating a transverse flow component in the fluid (see Fig. 5A), the microfluidic channels including a channel surface having at least one groove or protrusion (510) defined therein, the microfluidic channel having a cross-section defined between a first sidewall (210) and a second sidewall (2100), wherein the groove or protrusion (510) extends across a majority of the cross section. Regarding claims 29 and 30, Reynolds number being low is achieved simply be having a low flow rate; therefore, these claims do not further structurally limit the claimed article. Regarding claim 32, a network of microfluidic channels are fluidically connected to the channel (see Fig. 2). Regarding claims 34 and 35, both circular and rectangular cross sections are disclose (see Figs. 2 and 5B). Regarding claim 70, the protrusion (510) extends from the first sidewall (210).

#### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 2-4, 12, 31, 34, 37-52 and 72-74 are rejected under 35 U.S.C. 103(a) as being unpatentable over Larsen (US 6,241,379). Regarding claims 2-4, 13, 31 and 34, the device of Larsen ('379) was discussed above. The term "micromixer" (see col. 1, lines 11-36), would have suggested dimensions within the claimed ranges to one of ordinary skill in the art. See *In re Dailey* 149 USPQ 47 (CCPA 1966) regarding the obviousness of selecting a shape. Regarding claims 37, 43 and 44 , Larsen ('379) discloses a an article (1) comprising a structure having a first channel (one of 11), as second channel (another of 11) and a third channel (3) connecting the first and second channels and comprising a channel surface having grooves or protrusions (7) defined therein, the third channel designed to have a fluid flowing therethrough in a principle direction, the third channel including a channel surface having a plurality of chevron shaped grooves or protrusions (7) formed there in at least a portion of the channel surface so that each chevron-shaped groove or protrusion has an apex that defines an angle (see Fig. 7). The term "micromixer" (see col. 1, lines 11-36), would have suggested dimensions within the claimed ranges to one of ordinary skill in the art. Regarding claim 38, the apex angle is about 45 degrees (see Fig. 7). Regarding claim 39, the channel includes a first set of chevron shaped grooves or protrusions and a second set of chevron shaped grooves or protrusions (see Fig. 7). Regarding claim 40, the apex of each of the first set of chevron-shaped grooves or protrusions are aligned relative to the apex of each of the second set of chevron shaped grooves or protrusions. Regarding claim 41, the structure comprises a capillary tube (11). Regarding claim 42, the structure comprises a polymer (see col. 8, line 23). Regarding claim 45, the channel

is fluidically connected to a network of microfluidic channels (11). Regarding claim 46, the chevron-shaped grooves or protrusions are periodically spaced from each other (see Fig. 7). Regarding claim 47, the channel has a rectangular cross section (see Fig. 5). Regarding claim 49, the channel is a microfluidic channel (see col. 1, lines 12-36). Regarding claim 50, the channel is defined on a unitary structure (see col. 6, lines 18-27). Regarding claim 51, Larsen ('379) discloses a structure comprising a first channel (one of 10), a second channel (another of 10), and a third channel (3) having a principle direction and connecting the first and third channels and comprising a channel surface having protrusions (7) wherein a first region comprises a first set of protrusions (some of the upwardly sloping legs of chevrons 7 as seen in Fig. 7) oriented at a first angle relative to the principle direction, and a second region comprising a second set of protrusions (some of the downwardly sloping legs of the chevrons 7 as seen in Fig. 7) oriented at a second angle relative to the principal direction. Regarding claim 52, the structure comprises a polymer (see col. 8, line 23). Regarding claims 72 and 74, the third channel includes a sidewall (6) and at least one chevron shaped protrusion (7). Regarding claim 73, the third channel includes a sidewall (6) an at least one groove or protrusion (7) extends from the sidewall.

***Allowable Subject Matter***

8. Claim 31 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Claim 71 would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, 2nd paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

10. Claims 17-19, as currently amended, are not rejected under section 112.
11. Larsen ('379) clearly discloses projections 7 extending from sidewall (6).
12. Lui et al. is not relied upon in rejecting the currently amended claims.
13. Desai ('678) clearly disclose projection 510 extending from sidewall 210.
14. Desai ('678) is not relied upon in rejecting claim 51 as currently amended.

***Conclusion***

15. Applicant's amendment necessitated the new grounds of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David L. Sorkin whose telephone number is 571-272-1148. The examiner can normally be reached on 9:00 -5:30 Mon.-Fri..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wanda L. Walker can be reached on 571-272-1151. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



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Primary Examiner  
Art Unit 1723

DLS